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Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of the claims:

1. (previously presented) A method of storing page link information comprising:
obtaining page link information for a set of pages, the page link information
including for each page in the set a row of page identifiers of other pages;
arranging the rows of page identifiers in a particular order;
for each respective row:
identifying a reference row, if any, that best matches the respective row in
accordance with predefined row match criteria; and
encoding the respective row as an identifier for the identified reference
row, if any, a set of deletes representing page identifiers that identify pages in the
identified reference row not in the respective row, and a set of adds representing page
identifiers that identify pages in the respective row not in the identified reference row.
2. (original) The method of claim 1, wherein the encoding for each respective row
includes Huffman coding values representing the set of deletes and the set of adds for
each respective row.
3. (original) The method of claim 1, wherein the encoding for each respective row
includes delta encoding the set of deletes and delta encoding the set of adds for each
respective row.
4. (currently amended) ~~The method of claim 1,~~ A method of storing page link information
comprising:
obtaining page link information for a set of pages, the page link information
including for each page in the set a row of page identifiers of other pages;
arranging the rows of page identifiers in a particular order;
for each respective row:

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identifying a reference row, if any, that best matches the respective row in accordance with predefined row match criteria; and

encoding the respective row as an identifier for the identified reference row, if any, a set of deletes representing page identifiers in the identified reference row not in the respective row, and a set of adds representing page identifiers in the respective row not in the identified reference row, wherein the encoding for each respective row includes delta encoding the set of deletes and delta encoding the set of adds for each respective row; and Huffman coding the delta encoded set of deletes and delta encoded set of adds for each respective row.

5. (original) The method of claim 4, including sorting the page identifiers in each row in numerical order prior to performing the encoding.

6. (original) The method of claim 5, wherein the encoding includes generating a row distance value that identifies the identified reference row and Huffman coding the row distance value.

7. (original) The method of claim 4, including when no reference row exists for a respective row, encoding the respective row by encoding a null reference row identifier and a set of adds representing the page identifiers in the respective row, delta encoding the set of adds for the respective row, and Huffman coding the delta encoded set of adds for the respective row.

8. (original) The method of claim 1, including when no reference row exists for a respective row, encoding the respective row by encoding a null reference row identifier and a set of adds representing the page identifiers in the respective row.

9. (previously presented) A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism comprising:

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a first module for obtaining page link information for a set of pages, the page link information including for each page in the set a row of page identifiers of other pages;
and

a second module for storing the page link information, including instructions for:
arranging the rows of page identifiers in a particular order;

for each respective row:

identifying a reference row, if any, that best matches the respective row in accordance with predefined row match criteria; and

encoding the respective row as an identifier for the identified reference row, if any, a set of deletes representing page identifiers that identify pages in the identified reference row not in the respective row, and a set of adds representing page identifiers that identify pages in the respective row not in the identifier reference row.

10. (original) The computer program product of claim 9, wherein the encoding instructions of the second module include instructions for Huffman coding values representing the set of deletes and the set of adds for each respective row.

11. (original) The computer program product of claim 9, wherein the second module includes instructions for delta encoding the set of deletes and delta encoding the set of adds for each respective row.

12. (currently amended) ~~The computer program product of claim 9;~~ A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism comprising:

a first module for obtaining page link information for a set of pages, the page link information including for each page in the set a row of page identifiers of other pages;
and

a second module for storing the page link information, including instructions for:
arranging the rows of page identifiers in a particular order;
for each respective row:

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identifying a reference row, if any, that best matches the respective row in accordance with predefined row match criteria; and

encoding the respective row as an identifier for the identified reference row, if any, a set of deletes representing page identifiers in the identified reference row not in the respective row, and a set of adds representing page identifiers in the respective row not in the identifier reference row, wherein the encoding instructions of the second module include instructions for delta encoding the set of deletes and delta encoding the set of adds for each respective row, and for Huffman coding the delta encoded set of deletes and delta encoded set of adds for each respective row.

13. (original) The computer program product of claim 12, wherein the second module includes instructions for sorting the page identifiers in each row in numerical order prior to performing the encoding.

14. (original) The computer program product of claim 13, wherein the encoding instructions of the second module include instructions for generating a row distance value that identifies the identified reference row and Huffman coding the row distance value.

15. (original) The computer program product of claim 12, wherein the second module includes instructions, used when no reference row exists for a respective row, for encoding the respective row by encoding a null reference row identifier and a set of adds representing the page identifiers in the respective row, delta encoding the set of adds for the respective row, and Huffman coding the delta encoded set of adds for the respective row.

16. (original) The computer program product of claim 9, wherein the second module includes instructions, used when no reference row exists for a respective row, for encoding the respective row by encoding a null reference row identifier and a set of adds representing the page identifiers in the respective row.

17. (currently amended) A web crawler system, comprising:

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a central processing unit for performing computations in accordance with stored procedures;

a network interface for accessing remotely located computers via a network;
memory, coupled to the central processing unit, for storing procedures and data, including:

a web crawler module, executable by the central processing unit, for downloading a set of pages from remotely located servers via the network interface;

a first module for obtaining page link information from the set of pages, the page link information including for each page in the set a row of page identifiers of other pages; and

a second module for storing the page link information, including instructions for:
arranging the rows of page identifiers in a particular order;
for each respective row:

identifying a reference row, if any, that best matches the respective row in accordance with predefined row match criteria; and

encoding the respective row as an identifier for the identified reference row, if any, a set of deletes representing page identifiers that identify pages in the identified reference row not in the respective row, and a set of adds representing page identifiers that identify pages in the respective row not in the identified reference row. [[:]]

18. (original) The system of claim 17, wherein the encoding instructions of the second module include instructions for Huffman coding values representing the set of deletes and the set of adds for each respective row.

19. (original) The system of claim 17, wherein the encoding instructions of the second module include instructions for delta encoding the set of deletes and delta encoding the set of adds for each respective row.

20. (currently amended) ~~The system of claim 17,~~ A web crawler system, comprising:

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a central processing unit for performing computations in accordance with stored procedures;

a network interface for accessing remotely located computers via a network; memory, coupled to the central processing unit, for storing procedures and data, including:

a web crawler module, executable by the central processing unit, for downloading a set of pages from remotely located servers via the network interface;

a first module for obtaining page link information from the set of pages, the page link information including for each page in the set a row of page identifiers of other pages; and

a second module for storing the page link information, including instructions for: arranging the rows of page identifiers in a particular order; for each respective row:

identifying a reference row, if any, that best matches the respective row in accordance with predefined row match criteria; and

encoding the respective row as an identifier for the identified reference row, if any, a set of deletes representing page identifiers in the identified reference row not in the respective row, and a set of adds representing page identifiers in the respective row not in the identified reference row, wherein the encoding instructions of the second module includes instructions for delta encoding the set of deletes and delta encoding the set of adds for each respective row, and for Huffman coding the delta encoded set of deletes and delta encoded set of adds for each respective row.

21. (original) The system of claim 20, wherein the second module includes instructions for sorting the page identifiers in each row in numerical order prior to performing the encoding.

22. (original) The system of claim 21, wherein the encoding instructions of the second module include instructions for generating a row distance value that identifies the identified reference row and Huffman coding the row distance value.

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23. (original) The system of claim 20, wherein the second module includes instructions, used when no reference row exists for a respective row, for encoding the respective row by encoding a null reference row identifier and a set of adds representing the page identifiers in the respective row, delta encoding the set of adds for the respective row, and Huffman coding the delta encoded set of adds for the respective row.

24. (original) The system of claim 17, wherein the second module includes instructions, used when no reference row exists for a respective row, for encoding the respective row by encoding a null reference row identifier and a set of adds representing the page identifiers in the respective row.

25. (previously presented) A computer implemented method of storing web links of web pages, comprising:

assigning identification numbers to universal resource locators (URLs) of web pages and to URLs of web links associated with the web pages;

arranging the identification numbers of the web pages in numerical order; and

encoding web links associated with a particular web page as:

(1) a pointer to another identification number having a list of identification numbers that identify web pages,

(2) a list of delete numbers that represent identification numbers included in the list of identification numbers of the another identification number but not associated as web links with the particular web page, and

(3) a list of add numbers that represent identification numbers associated as web links with the particular web page but not included in the list of identification numbers of the another identification number.

26. (previously presented) The method of claim 25 wherein the identification numbers are consecutive integers.

27. (previously presented) The method of claim 25 wherein the identification numbers are positive integers densely allocated starting about zero.

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28. (previously presented) The method of claim 25 further comprising removing, for a web page, duplicate identification numbers that correspond to multiple web links that point to identical web pages.

29. (previously presented) The method of claim 25 wherein an index in a database for a respective web page is the identification number of the respective web page.